

Broadband, 802.16 and WiMAX

Khoo Teng Lock
Government Relations Office
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WiMAX



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What is Broadband?

- Recommendation ITU-R F.1399
 - BWA connection capabilities that are higher than the primary rate.
 - Primary Rate: Up to 1.544 Mbps service on a T-1 or up to 2.048 Mbps service on an E1 line
- National Policy driven
 - Connections that can deliver the desired applications to the community at large or to rural communities.
 - VoIP, Internet access (e-government applications/submissions)
- Malaysian broadband definition:
 - Any service beyond the scope of existing PSTN/ISDN and 2G cellular networks
 - With data rates that exceed the the normal voice-related speed (56 kbps for PSTN and 64 kbps for ISDN)
 - Can support the delivery of interactive multimedia (video, image, data, music, telephone and other applications) services to consumers.



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WiMAX forum

- An industry-led, non-profit corporation with more than 400 members, including leading equipment manufacturers, service providers and systems integrators
- Certifies compatibility and interoperability of broadband wireless products
- Supports the industry-wide acceptance of the IEEE 802.16 and ETSI HiperMAN wireless MAN standards
- WiMAX Forum promotes reasonable royalties through a standards-based solution



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What is WiMAX

- Wireless Metropolitan Area Networks (MAN)
- Offering Broadband Wireless Access
- Last/first mile wireless broadband connectivity
- Video, Data, Voice and Backhaul
- Rural, Urban and Suburban
- Non-Line-Of-Sight Fixed, Nomadic, and Mobile wireless broadband connectivity



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IEEE 802.16 Standards in WiMAX

- Frequency range:
 - 2 to 11 GHz, NLOS licensed and unlicensed
 - 10 to 66 GHz, LOS
- IEEE 802.16-2004 was released in 2003
 - Fixed WiMAX
- IEEE 802.16e-2005 was concluded in 2005
 - Mobile WiMAX
- ▶ IEEE 802.16 does NOT specify
 - specific frequency bands
 - the duplexing in a frequency band: both TDD & FDD supported
 - certification requirements



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WiMAX certification

- Development of Test Scripts for Validation
- Lab Preparation- involves validating test scripts, sourcing relevant test tools, opening the lab, preparing test hardware, integrating test scripts into the test hardware and accepting vendor equipment
- Validation testing of Test Scripts and Test Bed
 - Before a test script is released for use in the lab (test bed), it must be tested with a minimum of three (3) vendor products for a given profile.
- Certification Testing
 - Conformance testing to verify a vendor's implementation of the standard is compliant to a set of 802.16-specifications selected by the WiMAX Forum.
 - Interoperability testing to verify:
 - a vendor's subscriber unit is able to establish a link and communicate with two other vendor's base stations, or
 - a vendor's base station is able to establish a link and communicate with two other vendor's subscriber unit



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System & Certification Profiles

- System profile
 - is a complete set of MAC and PHY layer features and their associated parameters, which collectively specify the WiMAX system definition based on the IEEE 802.16 and ETSI HiperMan standards.
 - also defines radio layer, Duplex mode, and a Power Class. The system profile as approved by the WiMAX Forum is defined by the Technical Working Group (TWG).
- Certification Profile
 - is a subset of the system profile specifying
 - the supported channel bandwidth
 - duplex mode (e.g. 3.5GHz, 5MHz, TDD) for each applicable frequency band.
- WiMAX Forum Certification of products are tested and certified to a specific certification profile.
- Selection of certification profiles are based upon market demand.



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WiMAX system profiles

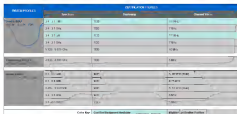
WiMAX system profiles: Fixed, Mobile and Evolutionary WiMAX			
	Fixed WiMAX	Mobile WiMAX	Evolutionary WiMAX
Standard	IEEE 802.16-2004	IEEE 802.16e-2005	IEEE 802.16e-2005
Multiplexing	OFDM	OFDMA	OFDM
FFT size	256	512-1024	256
Channeling mode	TDD FDD HFDD	TDD FDD HFDD ¹	TDD FDD HFDD
Modulation	BPSK, QPSK, 16-QAM, 64-QAM	QPSK, 16-QAM, 64-QAM (optional)	BPSK, QPSK, 16-QAM, 64-QAM (optional)
Channel bandwidth	3.5, 7, 10 MHz	5, 7 & 7.5, 10 MHz	3.5, 5, 7 MHz
Frequency bands	3.4-3.6 GHz 5.7-5.8 GHz	2.3-2.4 GHz 2.305-2.320, 2.345-2.360 GHz 2.486-2.49 GHz 3.3-3.4 GHz 3.4-3.5 GHz	2.305, 2.320, 2.345-2.360 GHz 3.4-3.6 GHz 4.9-5.0 GHz

Source: Motorola



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Currently Approved Certification Profiles

WiMAX System Profiles and Currently Approved Certification Profiles¹¹ Location and/or other conditions may apply to the use of the above information. Please consult Motorola for more information on the use of this information.

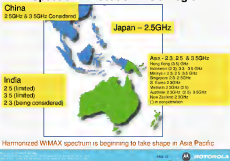
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BSA Spectrum Allocation: Asia Region



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WiMAX 2.3 GHz band

Certification Profiles

System Profile	Frequency band	Duplexing	Channel width
Mobile WiMAX	2300 – 2400 MHz	TDD	5, 10, 6.75 MHz

*Korea

- This is a key globally harmonized band for mobile WiMAX (802.16e) and is becoming the regional harmonized band in Asia
- Spectrum per operator: 20 to 30 MHz.
- Certified Mobile WiMAX equipment in this band is expected to be available from several vendors this year.

TDD is preferable for broadband data-centric services



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WiMAX 2.5 GHz band

Certification Profiles

System Profile	Frequency band	Duplexing	Channel width
Mobile WiMAX	2496 – 2690 MHz	TDD	5, 10 MHz

- This is the most important globally harmonized band for mobile WiMAX (802.16e).
- Spectrum per operator: 20 to 30 MHz
- Certified Mobile WiMAX equipment in this band is expected to be available from several vendors this year.



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WiMAX 3.5 GHz band

Certification Profiles

System Profile	Frequency band	Duplexing	Channel width
Fixed WiMAX	3400 – 3600 MHz	TDD, FDD	3.5 , 7 MHz
Mobile WiMAX	3400 – 3600 MHz	TDD	5, 7 MHz

- Certified equipment in this band is already available from several vendors.
 - As at Nov 2006: 13 vendors for base station; 13 vendors for CPE
- Spectrum per operator: 20 to 30 MHz



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Mobile WiMAX & IMT-2000

- IEEE submitted a contribution to the ITU-R WP8F meeting held in Cameroon in January 2007
 - that ITU-R Recommendation M.1457-6 be revised to add a new radio interface designated as IP-OFDMA
- IP-OFDMA is consistent with mobile WiMAX Release-1 profiles specifying
 - TDD and 5 & 10 MHz channel widths
- Mobile WiMAX is currently the only global open standard that employs OFDMA technology and has evolved from a data-centric vision
- Since year 2000, no new technologies have applied to M.1457



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Summary

- Broadband is defined to further national objectives
- WiMAX standards are based on IEEE 802.16
- WiMAX forum defines systems & certification profiles and enables the creation & management of a certification programme.
- Harmonized WiMAX spectrum is beginning to take shape in Asia Pacific in the 2.3 GHz, 2.5 GHz and 3.5 GHz bands.
- Desired amount of spectrum per operator is 20 to 30 MHz
- The addition of IP-OFDMA in M.1457 will introduce a global open standard that has evolved from a data-centric vision to complement 3G technologies that have evolved from initial focus on voice.



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Resources on WiMAX information

- General public
 - <http://www.wimaxforum.org>
- Regulators
 - <http://www.wimaxforum.org/regulators>



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Thank You



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